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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/807,190	03/24/2004	Takeshi Yamamoto	57810-091	3715

<sup>7590</sup>  
McDERMOTT, WILL & EMERY  
600 13th Street, N.W.  
Washington, DC 20005-3096

<sup>11/17/2008</sup>

EXAMINER
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TRINH, THANH TRUC

ART UNIT	PAPER NUMBER
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1795

MAIL DATE	DELIVERY MODE
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11/17/2008

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/807,190	<b>Applicant(s)</b> YAMAMOTO ET AL.	
	<b>Examiner</b> THANH-TRUC TRINH	<b>Art Unit</b> 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 09 October 2008.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,3-13 and 15-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,3-13 and 15-22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>10/1/08</u> .   | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 10/09/2008 has been entered.

### ***Remark***

2. Claims 1, 3-13 and 15-22 are pending in the application.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 4 and 16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 4 and 16 recite the limitation "said first conductivity type crystalline semiconductor layer" in line 4. There is insufficient antecedent basis for this limitation in the claim. It should be changed to "said first conductivity type single crystalline silicon semiconductor layer."

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
  2. Ascertaining the differences between the prior art and the claims at issue.
  3. Resolving the level of ordinary skill in the pertinent art.
  4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
4. Claims 1, 3-8, 10-11, 13, 15-19 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakata et al. (US Patent Application Publication 20010008295) 6133522) in view of Kloppel et al. (PGPub 20030170449) and further in view of Kataoka et al. (US Patent 6133522).

Regarding claims 1, 5-7, 10-11, 13, 17-18 and 21, as seen in Figures 1-2, Sakata et al. teaches a photovoltaic device comprising a photovoltaic element comprising a first conductivity type of single crystalline silicon semiconductor layer (1 as seen in Figures 1-2); a substantially intrinsic non-single-crystalline semiconductor layer (or i-type a-Si layer 2 in Figure 1, 2 and 7 in Figure 2) formed on the first conductivity semiconductor layer; a transparent conductive oxide film (transparent electrode 5 made of ITO, or

SnO<sub>2</sub> added In<sub>2</sub>O<sub>3</sub> in Figure 1, 5 and 10 in Figure 2 - See paragraphs 0036, 0062), and a collector electrode of Ag (See paragraph 0036). As seen in Figures 1-2, Sakata et al. teaches a surface of the crystalline semiconductor layer (1) is textured so that irregularities of the crystalline semiconductor is higher than the thickness of the transparent conductive oxide film (5) of 600-1500 Angstroms (or 60 nm - 150 nm - See paragraph 0036). Therefore it would have been obvious to have the irregularities of the crystalline semiconductor layer higher than the height of the irregularities on the surface of the transparent conductive oxide film.

The differences between Sakata et al. and the instant claims are the requirements of the transparent conductive oxide (ITO) film having an arithmetic mean deviation of the profile (or mean surface roughness) of not more than about 2 nm; a paste electrode formed on the transparent oxide film, wherein the paste electrode contains at least 60 percent by weight and not more than 100 percent by weight of epoxy resin; and an electric wire connected to the paste electrode.

Kataoka et al. teaches a collector electrode (505) formed on the transparent conductive oxide of ITO (504), wherein the silver collector electrode in a form of paste electrode of silver and a resin material (epoxy). (See col. 9 lines 10-29). The resin material can contains 100% epoxy resin, therefore it meets the limitation of "at least about 60 percent by weight and not more than about 100 percent by weight of epoxy resin". Kataoka et al. also teaches a copper tab or a tin foil (506a) attaching to the paste electrode 505. (See col. 9 lines 30-37 or col. 14 lines 37-47). It is the Examiner's position that the copper tab or tin foil is an electric wire.

Kloppel et al. teach the transparent conductive oxide film of ITO having an arithmetic mean deviation of the profile (or surface roughness) of less than 1 nm. (See paragraph [0013]). Applicant's disclosure states that "the contact angle of water on the surface of the ITO film is at least about 40° and not more than about 74° when the arithmetic mean deviation of the profile (Ra) of the ITO film is in the range of at least 0.5 nm to not more than about 2 nm" (Specification, page 35 line 23 – Page 36 line 8 and Figure 8). As the surface roughness of transparent conductive oxide film (ITO) in the range of less than 1 nm and, the Examiner considers that the contact angle of water with respect to the surface of the transparent conductive oxide film is at least about 40° and not more than about 74°.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify to device of Sakata et al. by having the paste electrode of silver and epoxy resin and the electric wire as taught by Kataoka et al., and the surface roughness of ITO less than 1 nm (or a contact angle of at least about 40° and not more than about 74° with respect to water) as taught by Kloppel et al; because Kataoka et al. finds that conductive paste such as silver and epoxy is suitable for collector electrode and equivalent to silver collector electrode (See col. 9 lines 10-29 of Kataoka et al.), and the electric wire such as copper tab 506a is used as an output terminal (See col. 9 lines 30-37 of Kataoka et al.); and because Kloppel et al. teaches it would avoid spikes by having the roughness of the ITO less than 1 nm, thereby enhancing conductivity and adhesion. (See paragraph [0005]-[0006]). In such combination, the irregularities of the surface of the crystalline semiconductor layer (1), which is higher than the thickness of

the transparent conductive oxide of 60-150 nm, would have been obviously higher than the irregularities of the transparent conductive oxide of height of less than 1 nm (or the surface roughness of 1nm).

Regarding claims 3 and 15, as seen in Figures 1-2, Sakata et al. teaches the photovoltaic element further comprising a second conductivity type non-single-crystalline semiconductor layer (or p-type a-Si layer 4) formed on the intrinsic non-single-crystalline (2) and the transparent conductive oxide film (5) is formed on the second conductivity type non-single-crystalline semiconductor layer (4).

Regarding claims 4 and 16, as seen in Figure 2, Sakata et al. teaches the intrinsic non-single-crystalline semiconductor layer (i-type a-Si layers 2 and 7) includes first (2) and second (7) intrinsic non-single-crystalline semiconductors formed on the upper and lower surfaces of the first conductivity type single crystalline semiconductor layer (1), respectively; a second conductivity type non-single crystalline (p-type a-Si layer 4) formed on the upper surface of the first intrinsic non-single-crystalline semiconductor layer (2); a first conductivity type fourth non-single crystalline semiconductor layer (n-type a-Si semiconductor layer 9); and the transparent conductive oxide film (5 and 10 as seen in Figure 2, paragraph 0062) including a first transparent conductive oxide film (5) formed on the upper surface of the third non-single crystalline semiconductor layer (4) and a second transparent conductive oxide film (10) formed on the lower surface of the fourth non-single crystalline semiconductor layer (9) .

Regarding claims 8 and 19, Kloppel et al. teach the content of indium oxide in the ITO is 90% and that of the tin oxide is 10% (See paragraphs 0008 or 0027). It was

found that the content of Sn in the transparent conductive oxide film is about 5% by weight.

5. Claims 9 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakata et al. in view of Kloppel et al. and Kataoka et al. and further in view of Kitae et al. (PGPub 20010005053).

Sakata et al. in view of Kloppel et al. and Kataoka et al. teaches a photovoltaic device as applied to claims 1, 3, 5-8, 10-11, 12, 15-19 and 21 above.

Sakata et al. in view of Kloppel et al. and Kataoka et al. does not teach the paste electrode containing urethane resin in addition to the epoxy resin.

Kitae et al. teach providing urethane resin in addition to the epoxy resin in the paste electrode. (See paragraph [0071]).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Sakata et al. in view of Kloppel et al. and Kataoka et al. by utilizing urethane resin as taught by Kitae et al., because it would increase adhesion strength. (See paragraph [0076]).

6. Claims 12 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sakata et al. in view of Kloppel et al. and Kataoka et al. and further in view of Morizane et al. (US Application Publication 20010045505)

Sakata et al. in view of Kloppel et al. and Kataoka et al. teaches a photovoltaic device as applied to claims 1, 3, 5-8, 10-11, 12, 15-19 and 21 above, wherein Kataoka



et al. describes a plurality of the photovoltaic elements provided at a prescribed interval and connected in series by electric wires (copper tab and tin foil), wherein the photovoltaic element includes a first paste electrode (formed on the upper surface of photovoltaic element. (See Figures 1 and 5, col. 14 lines 37-47).

Sakata et al. in view of Kloppel et al. and Kataoka et al. does not teach a second paste electrode formed on the lower surface of the photovoltaic element.

Morizane et al. teaches using a second collector electrode (18). (See Figure 1 and paragraph [0052])

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Sakata et al. in view of Kloppel et al. and Kataoka et al. by utilizing the second collector electrode as taught by Morizane et al., because it would enable light to enter from both front and rear surfaces. (See paragraph [0051]). In such combination, it would certainly have been obvious that the second collector electrode can be a paste collector electrode like the first collector electrode 505 of Kataoka et al. It also would have been obvious to one having ordinary skill in the art at the time the invention was made to connect the first end of the electric wire (copper tab or tin foil) to the first paste electrode of one cell and the second end of the electric wire to the second paste electrode of another cell as taught by Morizane et al., because in this way the photovoltaic elements are connected in series as taught by Kataoka et al.

### ***Response to Arguments***

Applicant's arguments with respect to claims 1 and 3-22 have been considered but are moot in view of the new ground(s) of rejection.

Applicant argues none of the references teaches the limitation of "a first conductivity type single crystalline silicon semiconductor." However, the Examiner respectfully disagrees. As seen in Figures 1-2, Sakata et al. teaches a first conductivity type (n-type) single crystalline semiconductor layer 1.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to THANH-TRUC TRINH whose telephone number is (571)272-6594. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1795

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Nam X Nguyen/  
Supervisory Patent Examiner, Art Unit 1753

TT  
10/13/2008